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(दूसरा पुनरीक्षण)

Indian Standard

AIRCRAFT — ALUMINIUM AND WROUGHT ALUMINIUM ALLOY RIVETS — GENERAL REQUIREMENTS

(*Second Revision*)

ICS 49.030.60

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

October 2004

Price Group 3

Aircraft, Space Vehicles, Air Cargo Handling and Aircraft Electrical Equipment Sectional Committee, TED 14

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Aircraft, Space Vehicles, Air Cargo Handling and Aircraft Electrical Equipment Sectional Committee had been approved by the Transport Engineering Division Council.

This Indian Standard was originally published in 1979 and revised in 1996. As a result of experience gained by the users, this revision has been taken up to include additional requirements including one more grade of material and its test requirements.

In the preparation of this standard, assistance has been derived from ISO 9418 : 1998 'Aerospace — Rivets, solid, in aluminium or aluminium alloys Procurement specification.

This standard is one of the series of the Indian Standards for rivets to be used for aircraft. Since the rivets for aircraft are normally used in highly stressed applications, these need to be produced under closely controlled and in most cases by special and restricted methods of manufacture and inspection.

The composition of the Committee responsible for the formulation of this standard is given in Annex B.

Indian Standard

AIRCRAFT — ALUMINIUM AND WROUGHT ALUMINIUM ALLOY RIVETS — GENERAL REQUIREMENTS

(Second Revision)

1 SCOPE

This standard specifies the general requirements for rivets of aluminium and wrought aluminium alloys for use in aircraft.

2 REFERENCES

The following standards contain provisions, which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
1868 : 1996	Anodic coatings on aluminium and its alloys — Specification (*third revision*)
3577 : 1992	Wrought aluminium and aluminium alloys rivet, bolt and screw stock — Dimensions and tolerances (*first revision*)
5242 : 1979	Method of test for determining shear strength of metals (*first revision*)
8513 : 1977	Aluminium alloy wire for cold forged rivets for aircraft purposes (Alloy 55000)
8514 : 1977	Aluminium alloy wire for cold forged rivets for aircraft purposes (Alloy 24530)
8936 : 1978	Aluminium alloy wire for cold forged rivets for aircraft purposes (Alloy 24350)
8937 : 1978	Aluminium alloy wire for cold forged rivets for aircraft purposes (Alloy 22500)
8938 : 1978	Aluminium alloy wire for cold forged rivets for aircraft purposes (Alloy 24345)

3 TERMINOLOGY

3.1 Batch

3.1.1 *Rivet Wires* — A batch consists of rivet wires weighing up to 250 kg of the same diameter and material manufactured in the same manner and heat treated together, if required and presented for complete testing and inspection.

3.1.2 *Rivets* — A batch consists of rivets of the same nominal dimensions, same form and manufactured in the same manner from rivet wires of the same cast and, if heat treated, that have bean heat treated together and is presented for testing and inspection.

3.2 Crack or Burst — A crack or burst is an abrupt interruption of the periphery of a rivet head caused by separation of metal.

3.3 Dud — It is an incomplete, mutilated or foreign part.

3.4 Harmful Defect — Any defect prejudicial to subsequent manufacture, fabrication or use of a material.

3.5 Heat Treatment — Annealed, solution treated, and aged at room temperature, or solution treated and precipitation treated as stipulated in the material specification.

3.6 Inspecting Authority — The body responsible for authorizing the manufacturer or supplier to issue certification. The manufacturer shall offer the material to the Inspection Authority for quality evaluation as per sampling plan specified.

3.7 Inspector — The individual responsible for executing inspection and release of material.

3.8 Manufacturer — The firm that produces the material in the form in which it is consigned to the purchaser.

3.9 Rivet — It is a headed unthreaded mechanical device formed from rod, wire or tubing, used to assemble two or more components by an applied force, which generally deforms the plain rivet end to develop a completed mechanical joint.

3.10 Rivet Length — It is measured between the largest diameter of the bearing surface of the rivet head to the extreme end in a line parallel with the axis of the rivet.

3.11 Supplier — The firm that consigns the material to the purchaser.

3.12 Test Results — Confirmation by the manufacturer or supplier that the material conforms to the requirements of the relevant specification, drawing or order.

3.13 Wire — A round, of not more than 10.0 mm diameter finished by drawing.

4 GENERAL REQUIREMENTS

4.1 Material

4.1.1 The chemical composition, condition of supply, heat treatment, mechanical properties, etc, for the rivet wire shall, unless specified otherwise, conform to IS 8513, IS 8514, IS 8936, IS 8937 and IS 8938.

4.1.2 The dimensions and tolerances for the rivet wire shall conform to IS 3577, if not specified in the relevant Indian Standard.

4.1.3 The elements not specified in the relevant specification of the material shall not be added for any purpose other than fluxing, degassing, grain refinement and the like.

4.1.4 *Grain Size*

The rivet wire of Grades 55000, 24530, 24350, 22500 and 24345 shall show a uniform fine microstructure. Under 100 × magnification the number of grains contained entirely within circle of 80 mm diameter and not cut by this circle, shall be at least 28.

4.1.5 *Workability*

The wires shall be so made that the original head and closing head can be properly formed. When upsetting, there shall be minimum ratio of 4 : 1 between diameter and head height of the head made for testing purpose. Individual skin-cracks are allowed but shear cracks are not permitted.

4.2 Dimension and Tolerances

4.2.1 The length of the rivet as defined in **3.10** and its diameter shall be within the tolerances mentioned in the relevant specification.

4.2.2 Unless otherwise specified, rivets shall have plain shear ends. The ends shall be at right angles within 2° of the axis of the rivet and reasonably flat.

4.2.3 The fillet radii under the head of the rivet shall not exceed 0.8 mm.

4.3 Finish

4.3.1 The finish of the rivets shall be Anodic unless otherwise agreed between the manufacturer or the supplier and the purchaser.

4.3.2 The surface of the wire shall not have any defects like furrow, metal separation, burrs, scales or foreign materials inclusion. Minor defects may be removed by suitable means provided the dimensions are not thereby affected.

4.3.3 Rivets with cracks as defined in **3.3** having a width of opening in excess of $0.002\ D + 0.05$ mm (where D is nominal diameter of the rivet head in mm) as measured at the periphery of the rivet head shall be rejected.

4.4 Shear Strength Test

Shear strength test shall be carried out in accordance with IS 5242 and the values shall meet the requirements specified.

5 IDENTIFICATION

5.1 The rivets shall be identified by the marking on the head or on the tail by embossing or indenting as specified by the relevant specification.

5.2 Additionally these shall be colour marked as required by the relevant specification. The designation for each type of rivet shall be mentioned in the individual specification.

6 TESTS

6.1 Dimensions

The samples shall be drawn as given in Table 1 and the accuracy shall be determined by using calibrated measuring instruments.

6.2 Material

6.2.1 The pieces from the destructive tests may be used and chemical composition shall meet the requirements specified.

6.3 Shear Strength

6.3.1 The rivets are mostly called upon to resist shear forces. The samples shall be drawn as given in Table 1.

6.3.2 Shear strength of test specimen shall be selected and tested in accordance with IS 5242 and shall not be less than the value as specified or as agreed to between the purchaser and the manufacturer.

6.3.3 Rivets that were heat-treated for shear strength test and whose strength does not meet with the requirements may be heat-treated again provided no excess heating is found.

6.3.4 In the case of non-heat treated rivets, whose strength does not meet with the requirements, the test shall be carried out as given in **7**.

6.4 Grain Size

6.4.1 At least three micro sections per batch of rivets shall be examined for conformity as given in **4.1.4**.

6.5 Workability

6.5.1 For testing samples to be selected as given in Table 1, testing shall be carried out as specified in **4.1.5** after the requirements of **6.5.2** are met. The testing is carried out with a hydraulic, continuously acting press.

6.5.2 For upsetting the corresponding head height, a spacing ring of the thickness of the head to be upset is placed between the upsetting plate and the pressing die. Rivets except of material Grade 55000 shall be tested after the heat treatment. Rivets of the material Grade 24530 would need to be tested within 1 h after the solution treatment quenching. If the workability of the test specimen is not satisfactory, the entire batch is to be rejected.

6.6 Flatness Test

6.6.1 For testing, samples to be selected as given in Table 1. From the selected samples a length equal to the full diameter of the rivet shall be cut from the shank. It is then cold flattened in the axial direction, until the diameter is equal to twice the original diameter. It shall not crack as a result of this test. The rivets of material Grade 24530 shall be tested within the period given in **6.5.2**.

6.7 Surface Finish

For testing, samples shall be selected as given in Table 1 and testing requirements shall be as per IS 1868.

7 RETEST

If a test sample fails to satisfy the requirements of the relevant test plan, twice the sample size may be selected and test reconducted. If on this retest, any sample does not satisfy the requirements, the entire batch shall be rejected.

8 TESTING AND TEST RESULTS

8.1 The rivets of the same batch shall be offered together for inspection and testing.

8.2 The manufacturer shall supply to the purchaser the necessary certificate in respect of all materials governed by the relevant Indian Standards.

8.3 Except as provided in **8.4** if any certificate is issued by a supplier other than the manufacturer, such supplier shall hold the equivalent certificate issued by the manufacturer of the material.

8.4 If a batch of material consigned by the manufacturer is subdivided by an approved (by the inspecting authority) non-manufacturer before reconsigning, the non-manufacturer shall carry out any requisite additional dimensional inspection and the identification marking shall be certified accordingly.

8.5 A specimen of the record of test results, which shall be packed with the material, is given at Annex A.

9 PACKING

9.1 The rivets shall be packed as agreed to between the purchaser and the supplier. Each unit of packing shall contain:

a) Rivets of only one form, size manufactured from one batch of material and, as far as possible, inspected together; and
b) Necessary record of test results as specified in **8**.

9.2 The packing shall be capable of protecting the rivets from damage during transit and storage by usual means.

10 MARKING

10.1 Each packed unit shall be legibly and indelibly marked with the following:

a) Manufacturer's name or trade-mark;
b) Rivet designation;
c) Quantity and batch number;
d) Month/year of manufacture; and
e) Particulars of inspector or inspector's stamp.

10.2 BIS Certification Marking

The material may also be marked with the Standard Mark.

10.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to the manufacturers or producers may be obtained from the Bureau of Indian Standards.

Table 1 Sampling Plan for Testing of Aluminium and Wrought Aluminium Alloy Rivets
(*Clauses* 6.1.1, 6.3.1, 6.5.1 *and* 6.7)

Sl No.	Lot Size	Test Characteristics														
		Dimensions			*Shear Strength*			*Workability*			*Flatness*			*Surface Finish*		
		n	*Ac*	*Re*	*n*	*Ac*	*Re*	*n*	*Ac*	*Re*	*n*	*Ac*	*Re*	*n*	*Ac*	*Re*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
i)	Up to 1 200	13	1	2	13	1	2	13	0	1	13	1	2	13	1	2
ii)	1 201-3 200	13	1	2	13	1	2	13	0	1	13	1	2	13	1	2
iii)	3 201-10 000	20	2	3	20	1	2	20	0	1	20	1	2	20	2	3
iv)	10 001-35 000	20	2	3	20	1	2	20	0	1	20	1	2	20	2	3
v)	Over 35 000	32	3	4	32	2	3	32	1	2	32	2	3	32	3	4

NOTE — *n* = No. of samples, *Ac* = Acceptance number, and *Re* = Rejection number.

ANNEX A

(*Clause* 8.5)

RECORD OF TEST RESULTS

Manufacturer .... Date of manufacture ....
IS No. .... Type of supply ....
Size . ... Heat treatment No. ....
Material .... Batch No. ....
Number of the melt .... Batch size ....

Test Results:

The dimensions agree with IS /IS /IS
[----Yes/No[1]]

Material:	Al	Mg	Cu	Si	Zn	Cr	Mn	Fe	Ti
Nominal:									
Actual:									

Tensile strength: Nominal ....N/m^2 Nominal: Specimen 1 ....N/m^2
Shear strength: Nominal ....N/m^2 Nominal: Specimen 1 ....N/m^2
Grain size: Coarse grain present ....Yes/No[1]
Workability: Shear cracks present ....Yes/No[1]
Surface condition: Surface defects exist ....Yes/No[1]
Flattening test:

The supply was manufactured, controlled and accepted as per the requirements of

IS ....
Place ....
Date ....

Signature of the Tester

---

[1] Strike off what does not apply.

ANNEX B

(*Foreword*)

COMMITTEE COMPOSITION

Aircraft, Space Vehicles, Air Cargo Handling and Aircraft Electrical Equipment Sectional Committee, TED 14

Organization	*Representative(s)*
Aerial Delivery R&D Establishment, Agra Cantt	Shri M. L. Sidana (***Chairman***)
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